3/3/17 "Its always too early to quit" - Norman Peale

HW: "Inverses of Linear Functions" homework section
Test 2 on Tuesday 3/14

AIM: How do we find inverses of linear functions?

Warm Up:

1. Evaluate: $\sum_{x=1}^{4}(x-2)^2 = \boxed{6}$

$(1-2)^2+(2-2)^2+(3-2)^2+(4-2)^2$

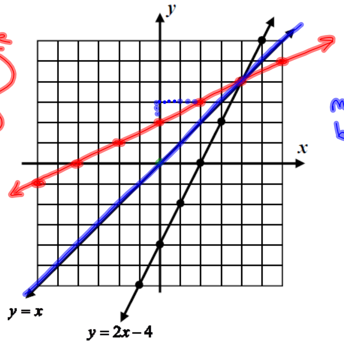
$1 + 0 + 1 + 4 = 6$

2. Evaluate: $\sum_{x=1}^{3}(x-1)^4 = \boxed{17}$

Recall that functions have inverses that are also functions if they are one-to-one. With the exception of horizontal lines, all linear functions are one-to-one and thus have inverses that are also functions.

***Exercise* #1:** On the grid below the linear function $y = 2x - 4$ is graphed along with the line $y = x$.

$y=2x-4$	Inverse
$(-1,-6)$	$(-6,-1)$
$(0,-4)$	$(-4,0)$
$(1,-2)$	$(-2,1)$
$(2,0)$	$(0,2)$
$(3,2)$	$(2,3)$
$(4,4)$	$(4,4)$
$(5,6)$	$(6,5)$



$m=\frac{1}{2}$
$b=2$

(a) How can you quickly tell that $y = 2x - 4$ is a one-to-one function?

Use the horizontal line test.

(b) Graph the inverse of $y = 2x - 4$ on the same grid. Recall that this is easily done by switching the x and y coordinates of the original line.

(c) What can be said about the graphs of $y = 2x - 4$ and its inverse with respect to the line $y = x$?

Reflexive symmetry about line $y=x$

(d) Find the equation of the inverse in $y = mx + b$ form.

slope $= \frac{1}{2} = m$ y-int $= 2$

$$y = \frac{1}{2}x + 2$$

(e) Find the equation of the inverse in $y = \dfrac{x+b}{a}$ form.

$y = \frac{1}{2}x + 2 \Rightarrow \frac{1x}{2} + \frac{2}{1}$

$$y = \frac{x+4}{2}$$

$\frac{1x}{2} + \frac{4}{2} = \frac{1x+4}{2}$

As we can see from part (e) in *Exercise* #1, inverses of linear functions include the inverse operations of the original function but in reverse order. This gives rise to a simple method of finding the equation of any inverse. **Simply switch the x and y variables in the original equation and solve for y.**

***Exercise* #2:** Which of the following represents the equation of the inverse of $y = 5x - 20$?

(1) $y = -\frac{1}{5}x + 20$ (3) $y = \frac{1}{5}x - 4$

(2) $y = \frac{1}{5}x - 20$ (4) $y = \frac{1}{5}x + 4$

Although this is a simple enough procedure, certain problems can lead to common errors when solving for y. Care should be taken with each algebraic step.

***Exercise* #3:** Which of the following represents the inverse of the linear function $y=\frac{2}{3}x+8$?

(1) $y=\frac{3}{2}x-8$ (3) $y=-\frac{3}{2}x+8$

(2) $y=\frac{3}{2}x-12$ (4) $y=-\frac{3}{2}x+12$

$x=\frac{2}{3}y+8$

$\left(\frac{3}{2}\right)(x-8)=\frac{2}{3}y\left(\frac{3}{2}\right)$

$\frac{3}{2}x-12=y$

***Exercise* #4:** What is the y-intercept of the inverse of $y=\frac{3}{5}x-9$?

(1) $y=15$ (3) $y=9$

(2) $y=\frac{1}{9}$ (4) $y=-\frac{5}{3}$

$x=\frac{3}{5}y-9$

$\frac{5}{3}(x+9)=\left(\frac{5}{3}\right)\frac{3}{5}y$

$\frac{5}{3}x+15=y$

$y=\frac{5}{3}x+15$

Sometimes we are asked to work with linear functions in their point-slope form. The method of finding the inverse and plotting it, though, do not change just because the linear equation is written in a different form.

***Exercise* #5:** Which of the following would be an equation for the inverse of $y+6=4(x-2)$?

(1) $y-2=\frac{1}{4}(x+6)$ (3) $y-6=-4(x+2)$

(2) $y-2=-\frac{1}{4}(x+6)$ (4) $y+2=-4(x-6)$

$\frac{x+6}{4}=\frac{4(y-2)}{4}$

$\frac{1}{4}(x+6)=y-2$

***Exercise* #6:** Which of the following points lies on the graph of the inverse of $y-8=5(x+2)$? Explain your choice.

(1) $(8,-2)$ (3) $(-10,40)$

(2) $(-8,2)$ (4) $(-2,8)$

Point $=(-2,8)$

Inverse Pt $=(8,-2)$

***Exercise* #7:** Which of the following linear functions would *not* have an inverse that is also a function? Explain how you made your choice.

(1) $y=x$ (3) $y=2$ $x=2$ ← vertical line

(2) $2y=x$ (4) $y=5x-1$

$2x=y$